

1912, *J. Lunell* (Cotype) (NY). Nebraska: On Middle Loup River, near Thedford, Thomas Co., Aug. 7, 1893, *P. A. Rydberg*, no. 1609 (NY); on South Fork of Dismal River, Aug. 12, 1893, *P. A. Rydberg*, no. 1609 [!] (US); on Middle Loup River, near Mullen, Hooker Co., Aug. 19, 1893, *P. A. Rydberg*, no. 1609 [!] (US); South Cody Lake, Sept. 19, 1915, *Ray Thomson* (US).

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Marine Flowering Plants

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It is, of course, well known that there are a great many genera and species of flowering plants which are not only able to live under very saline conditions along the sea-coasts of the earth and at the borders of salt lakes, but many which in fact thrive only in such situations and under such conditions and will not grow well, if at all, in any other habitat. Such plants are known as halophytes. Many scores of species of flowering plants grow regularly on land which is periodically inundated by rising tides of salt water (as, for example, *Eriocaulon parkeri*), while the value of mangroves (*Avicennia*, *Rhizophora*, *Laguncularia*) in extending the margin of land into the sea in the famous mangrove-lagoons of tropical regions is well known.

These plants, however, are all fundamentally terrestrial plants. It is not so well known by the general public or even by botanical students that a considerable number of genera and species of flowering plants actually are able and do live all of their lives in the sea, completely submerged at all times by the water of the earth's oceans, in company with the many thousands of microscopic and macroscopic species of blue-green, green, red, and brown algae, which are the true "seaweeds" as we usually think of them and which are flowerless and much more primitive types of plant life. The marine flowering plants often grow in colonies fully as extensive as those of some marine algae and are, in fact, often mistaken

for algae. However, they bear flowers essentially like those of all terrestrial flowering plants and produce seeds as do all phanerogams. They are true flowering plants which have merely become adapted to a marine existence.

A very cursory examination of literature reveals at least ten genera of these marine phanerogams and almost fifty species. These genera represent five different families of as many orders of primitive phanerogams: *Cymodoceaceae* [*Najadales*], *Ruppiceae* [*Potamogetonales*], *Zosteraceae* [*Aponogetonales*], *Posidoniaceae* [*Juncaginales*], and *Hydrocharitaceae* [*Butomales*]. A more intensive search of the literature would doubtless reveal more species and a thorough search of the sea-coasts of the earth would probably bring to light many as yet undiscovered and undescribed forms.

Probably the most famous of these marine flowering plants is *Zostera marina*, known popularly as "sea-wrack", "grass-wrack", and "eel-grass". This inhabits the coastal waters of Europe, Asia Minor, North America, and eastern Asia. It grows wholly under water, its long jointed stems rooting at the nodes and creeping along in the sand or mud of the ocean floor, sending up erect slender branches, which produce long and narrow, alternate, grass-like, ribbon-shaped leaves. The flowers are unisexual, naked, sessile, and hidden in a sheath. It is gathered in great quantities along with marine algae for manure. When dried it is extensively used for packing and by upholsterers under the name of "alva marina". Another species, *Z. nana*, inhabits the North Sea, Caspian Sea, Black Sea, Mediterranean, and the water around the Canary Islands. Other species inhabiting European waters are *Z. hornemanni* and *Z. dubia*, while off the coasts of Japan is found *Z. japonica*, in the Tasman Sea and Antarctic Ocean about Australia is found *Z. tasmanica*, and off the coasts of western North America *Z. pacifica*.

An interesting feature of the eel-grass is that it seems periodically to be attacked by some micro-organism which spreads with almost unbelievable rapidity and wreaks great destruction to the plants not only on one coast, but often throughout its distribution. Sometimes the attacks are local and then may in part be due to sudden changes in the salinity of the water or some other feature of the environment, but the literature is filled with references to periods when the plant was singularly scarce. At least twice in recorded history this scarcity was world-wide. The first of these

epidemics occurred in 1893-1894 and the second began in late 1929, reached its peak in 1931-1932, and persisted through to 1935 and later. C. Cottam in *Rhodora* 36: 261 and 37: 269 *et seq.*, has given graphic descriptions of these periods of scarcity and epidemic. The 1929-1935 epidemic is thought to have been caused by a protozoon of the genus *Labyrinthula*. Cottam reports that at about mid-summer in 1931 in most localities from New England to North Carolina the leaves of the eel-grass became somewhat darkened, broke from the stems of the plant, and washed ashore in great windrows. Before the summer was over less than one percent of a normal stand persisted in most affected areas. The Canadian coast south of the Gulf of St. Lawrence was denuded by the fall of 1932 and when ice cleared away in the spring of 1933 practically the entire area of the plant's regular range in that region was 99 percent destroyed. Since 1935 the plant has slowly been making a come-back into the areas which it formerly inhabited, much to the relief of lovers of our wild fowl, for it is a favorite food of plant-eating water fowl.

In the waters adjacent to Florida and Louisiana and from there southward in the Gulf of Mexico and the Caribbean Sea and in the waters of tropical South America is found *Thalassia testudinum*, known popularly as "turtle-grass" or "sea-weed". Dr. J. K. Small has written [Man. SE. Fl. 29, 1933] that this plant "occurs mainly in vast submarine fields, often forming a dense turf. The leaves are washed ashore in vast quantities and are gathered as 'seaweed' for fertilizer. Only during quiet weather, and consequently clear water, can one get an adequate view of these submarine fields, which are favorite rendezvous for various kinds of fish, turtles, and other marine animals". Two other species, *T. hemprichii* and *T. indica*, inhabit the waters of the Pacific and Indian Oceans in the general region of tropical Asia.

The genus *Ruppia* inhabits salt and brackish water along sea-coasts and also the ocean floor in quiet bays, coves, and river-mouths. Its commonest representative is *R. maritima*, known commonly as "ditch-grass", "tassel-pondweed", or "sea-grass", and found throughout the temperate and tropical portions of the earth in favorable situations. Other species include *R. rostellata* in the seas of Europe and tropical Asia, *R. intermedia* in Scandinavian waters, *R. zosteroides* originally found off Sicily, but probably

occurring throughout the Mediterranean region, *T. taquetii* in Korean waters and the China Sea, *R. obtusa* and *R. filifolia* in the waters adjacent to Patagonia, *R. anomala* in the Caribbean, *R. cirrhosa* in Italian waters, and *R. occidentalis*, *R. curvicarpa*, and *R. pectinata* in the waters of the Pacific along the shores of western North America. Some of the species of this genus are able to grow also in fresh water and may ascend rivers far beyond the area of tidal influence. On the western coast of North America is also the strange genus *Phyllospadix* with two known species: *P. scouleri* ranging from Vancouver Island and British Columbia south to Santa Barbara and other parts of California, and *P. torreyi*, known only from Californian waters. The latter is used extensively as fireproofing and deadening in filling between the walls of buildings. A peculiar monotypic genus is the genus *Enalus*, represented by *E. acoroides* in the waters of the Indian and western Pacific Oceans.

In the Mediterranean Sea and the waters adjacent to the Iberian Peninsula is found *Posidonia oceanica*. The only other known species of this genus, *P. australis*, inhabits the waters of extra-tropical Australia, Tasman Sea, and the Antarctic Ocean. The genus *Halophila* is widely distributed: *H. ovalis* in the Indian Ocean and South Seas, *H. stipulacca* and *H. beccarii* in the Indian Ocean and other waters adjacent to tropical Asia, *H. spinulosa* in the Japan Sea, Yellow Sea, and China Seas, through the South Seas, to the Coral Sea off northern Australia, and *H. baillonis* in the Caribbean.

The genus *Halodule* [*Diplanthera*] is known from three species: *H. wrightii* inhabits the waters of the Gulf of Mexico and Caribbean Sea, *H. australis* the Red Sea, and *H. uninervis* the Indo-Pacific Oceans. The genus *Amphibolis* is also represented by three species: *A. ciliata* in the waters of the Indo-Pacific Oceans and *A. bicornis* and *A. antarctica* in the Antarctic Ocean and Tasman Sea adjacent to Australia.

Probably the largest genus of marine phanerogams is the genus *Cymodocea*. One species, *C. manatorum*, known as "manatee-grass", inhabits the waters of the Gulf of Mexico and Caribbean Sea and may be looked for off the coasts of the southern United States and the West Indies. It is entirely marine and is seldom seen except when dredged up during dredging operations in bays or harbors or when washed ashore after storms. It is said to be a

favorite of the manatee or sea-cow. Other species of this widespread genus include *C. aequorea* in the Mediterranean, *C. rotundata* in the Red Sea, *C. preauxiana* and *C. webbiana* in the waters adjoining the Canary Islands, *C. griffithii* in the Antarctic off southern Australia, *C. angustata* in the southern Indian Ocean off the coasts of western Australia, *C. isoëtifolia* in the waters of the Indo-Pacific Oceans, *C. australis* in the Bay of Bengal, *C. asiatica* in the East China Sea around the Liu-kiu Islands, *C. acaulis* off the coasts of eastern Africa, *C. nodosa* in the Mediterranean, the waters adjacent to the Iberian Peninsula, and those off the coasts of northern and western Africa, and *C. serrulata* widely distributed in tropical seas.

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BOOK REVIEWS

A Manual of Aquatic Plants*

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Water plants are notoriously difficult to determine by the vegetative characters. Botanists in the Torrey Club range find the Key to Submerged and Surface-Floating Aquatics published by Miss Mary Barrett in the pamphlet Three Keys to Wild Flowering Plants helpful, but its range is very limited and the plants included are only those indicated by the title. Dr. Fassett has written a complete manual of the aquatic plants of the United States from Minnesota and Missouri east to the Gulf of St. Lawrence and Virginia. An aquatic is described as a plant that "may under normal conditions germinate and grow with at least its base in the water." For some reason bog and salt marsh plants are not included in the book. The general key in the first part of the book and the keys to species in the second part are based chiefly on vegetative characters. With the general key are sixteen plates to illustrate the terms used and the habits of the plants of each family. The descriptive treatment, besides keys to the species, has brief descriptions of each species and, with few exceptions, illustrations to show the whole plant with enlarged details where they help in identification. Fully half of the

* A Manual of Aquatic Plants. Norman Fassett. McGraw-Hill Book Co. 1940. vii+382 pages. \$4.00.